

**SMART AUTOMATIC RECORDING SYSTEM AND METHOD**  
**FOR MONITORING WAFER FRAGMENTATION**

**Field of the invention**

The present invention relates to a smart automatic recording system and  
5 method for monitoring wafer fragmentation to facilitate judgement, diagnosis,  
genuine factor verification, or engineering improvement and management for  
associated technicians by using photographing devices and a personal computer  
(PC).

**Background of the invention**

10 Because the perspectives of wafer factories are good and their throughputs  
expand continually, there is an abrupt increase in the equipment quantities and  
the degree of machine automation. However, the required training of  
technicians becomes more cumbersome, and it is difficult to reckon with  
machine anomalies occurring seldom such as wafer fragmentation or  
15 malfunction by long-term in-situ monitoring. Therefore, although the CMP  
Ebara machine has good stability, the problems of wafer fragmentation and  
wafer dropping due to unknown reasons may still occur.

To effectively inspect the reasons of wafer fragmentation and wafer  
dropping, the expedient is to perform the machine monitoring. However, the  
20 efficiency of using manpower for stationing or a recorder for recording is much  
unsatisfactory, and it is difficult to circularize and examine the data among  
many people. Moreover, the storage and management of data will be very  
bothersome.

## **Summary and objects of the present invention**

Accordingly, the primary object of the present invention is to provide a smart automatic recording system and method for monitoring wafer fragmentation to facilitate judgement, diagnosis, genuine factor verification, or  
5 engineering improvement and management for associated technicians.

The secondary object of the present invention is to provide a smart automatic recording system and method for monitoring wafer fragmentation, wherein only the image of a fragmentized wafer and the two images before it will be recorded. Therefore, cheap and convenient factor analysis can be  
10 obtained, and the space of the hard disk will not be wasted.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawings, in which:

### **Brief description of drawing:**

15 Fig. 1 is a diagram showing the actual hardware connection of the present invention;

Fig. 2 is a flowchart of a smart automatic recording method for monitoring wafer fragmentation according to an embodiment of the present invention;

Fig. 3 shows the process to capture, merge, and store the images of wafers;

20 Fig. 4 shows the process performed by means of IC design and a control card to capture, merge, and store the image of wafers;

Fig. 5 is a flowchart of an automatic monitoring system for burglarproof purpose of house derived and modified from the present invention.

### Detailed description of preferred embodiment

As shown in Fig. 1, a smart recording system for monitoring wafer fragmentation according a preferred embodiment of the present invention comprises a plurality of photographing devices 11 such as CCD cameras or  
5 general recorders so that the circumstances can be monitored when wafers are polished. The photographed images are then transferred to a multiple-image receiver 13 by a multiple-image transmitter 12. The photographed images are digitized and recorded simultaneously by a plurality of photographing devices. After the multiple-image receiver 13 receives the image signals, the images  
10 captured at the same time will be merged into the same image frame 14 by the multiple-image receiver 13. Next, the multiple-image receiver 13 transfers the image signals to the input terminal of an image-capturing card in a PC. The PC also receives the wafer-entry and wafer-exit signals and the signal of wafer fragmentation transferred from the I/O port of a polishing apparatus. A whole  
15 monitoring system is thus formed.

Please refer to Fig. 2. Three files Image(1), Image(2), and Image(3) set in the PC are first cleared (Step 21). A wafer-entry signal will be transferred to the PC by the polishing apparatus when a wafer enters the polishing apparatus (Step 22). The PC will issue instructions to the photographing devices to let  
20 them start to capture images and store the images into the file Image(3) (Step 23). The wafer will proceed to the polishing position and then leave the polishing apparatus when the polishing work is finished. From the moment when the wafer enters the polishing apparatus to the moment when it leaves the polishing apparatus, the photographing devices photograph and monitor

uninterruptedly, with the photographed images shiftably stored in the three files Image(1), Image(2), and Image(3) in the order of Image(3), Image(2), and Image(1). Speaking more clearly, when a new image is received, the image in Image(2) will be stored in Image(1), the image in Image (3) will be stored in Image(2), and the new image will be stored in Image (3). The photographing devices photograph the polishing process of a wafer until the PC receives a signal of wafer fragmentation or a wafer-exit signal from the polishing apparatus. When the situation of wafer fragmentation occurs (Step 24), an image-capturing system will maintain the status and stop the process (Step 241) so that technicians can analyze the images stored in the three files Image(1), Image(2), and Image(3) to find out the reason of wafer fragmentation easily (Step 242). After the problem has been resolved, the polishing process will be continued. Contrarily, if the polishing process is successful so that the situation of wafer fragmentation does not arise, the file Image(2) will be stored as the file Image(1), the file Image(3) will be stored as the file Image(2), and the file Image(3) will be cleared. The above procedures are repeated until the polishing work of the whole batch of wafers is finished.

Fig. 3 shows the process to capture, merge, and store the images of wafers, which process comprises the steps of:

- (1). capturing an image signal by a plurality of photographing devices;
- (2). transferring the image signal to an image receiver;
- (3). receiving the image signal by the image receiver;
- (4). merging the images captured at the same time into the same image frame by the image receiver;

(5). judging whether a wafer enters the polishing apparatus (judging whether the state of the store instruction is "ON");

(6). digitizing the captured image by an image-capturing card in a PC when a wafer enters the polishing apparatus;

5 (7). storing the digitized image into a file Image(3) set in the PC.

The photographing device used in Step (5) to judge whether a wafer enters the polishing apparatus can be a CCD camera. The judgement can be made according to the signal transferred from the I/O port of the polishing apparatus. After the image-capturing system in Step (4) maintains the status and stops the  
10 process, technicians can examine the reason of wafer fragmentation to resolve the problem so that normal polishing process can then be continued.

Fig. 4 shows the process performed by means of IC design and a control card to capture, merge, and store the image of wafers. The functional circuits of the above steps (3) to (7) are combined to form a control card so that a more  
15 compact system can be obtained.

Please refer to Fig. 5, wherein the signal from the I/O port is changed to be a break-in signal of a burglar. In other words, the system of present invention can be installed in a house as an automatic monitoring system for burglarproof purpose. Because the principle and procedures are identical to those described  
20 above, they will not be further illustrated.

Although the present invention has been described with reference to the preferred embodiments thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of

ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

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